

Intramolecular Electron Exchange within Aligned Two-Dimensional Materials Composed of Molecules Featuring Anisotropic Distribution of Stored Electrons Points Way to New Paradigm of Small-Form-Factor Voltage Cells

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Introduction

A rule of thumb when talking about voltage cells is that voltage cells which are capable of the highest-density energy storage take the longest to charge and tend to be less suitable for applications which call, for sudden bursts of power, such as for electric automobiles. Generally speaking, the materials which can be used to enable rapid charging and discharging of a voltage cell have as their drawback diminished storage capacity. Lithium-ion batteries exist in a middle ground between high storage-density systems used as backup power supplies for industry and capacitors.

Revolutionary cubic proton grid CFL-enabled hybrid voltage-cell/SASE generators, although suitable for automotive, residential and industrial energy needs are not practical when small-form-factor batteries are required. Thus, there will continue to be a market for small-form-factor batteries in the same vein as lithium-ion batteries.

If high storage-density materials could be coupled with medium-density, rapid-charge/discharge materials, it may be possible to create a voltage cell featuring the best of both worlds.

Abstract

A novel type of voltage cell may be manufactured based upon the use of large, ring-shaped two-dimensional molecules arrayed in two-dimensional sheets in which the atomic components of those molecules have variable storage densities and charge rates ranging from tantalum at the low-density end of the spectrum to lithium, with its consumer electronics-friendly attributes of moderate energy density and reasonably high rates of charge/discharge rates to other materials such as vanadium which have a higher density of electron storage but which require more time to charge and discharge.

By coupling materials with these disparate properties but simultaneously ensuring the alignment of these molecular rings (if the rings are thought of in terms of the face of a clock, the single tantalum atom might sit at the 3 O'clock position, the lithium components of the stacked rings might be made to occupy much of the right-hand portion of the clock face and the vanadium much of the left-hand portion.

Such a design would enable the intra-molecular flow of electrons when both charging and discharging. When elements such as vanadium are charged intra-molecularly, a more rapid charging may take place than if one attempted to store energy in vanadium in which vanadium was mediated only by more vanadium. The use of a two atoms of a semiconductor such as germanium as a mediator between the lithium and vanadium components enables the spontaneous "recharging" of the lithium component of the rings, even while the battery is in use i.e. being discharged. Thus, these rings would behave much as two distinct batteries in which one battery which takes longer to recharge but which holds more energy is configured to recharge the other, even as it is being discharged. As this process would take place on an intra-molecular basis, it would be far more efficient than the collocation of two distinct battery systems operating along such as principle.

This battery, importantly would be a solid-state battery in which only the tantalum component of the stacked rings are connected by a thin wire with a separate nanowire running through each of the aligned series of tantalum atoms. These wires would run to the cathode and facilitate the flow of current. As charge is depleted from the collective lithium atoms of such a battery, charge would be progressively restored by the comparatively energy-dense vanadium mediated by germanium. Palladium could be used in place of germanium, but is too dear to be practical for use in voltage cells.

Conclusion

This sort of design can shift the paradigm in small-form-factor voltage cell technology from one which is akin to operating a computer inefficiently via the use of a hard drive but without the speedier RAM component or with the RAM but without the hard drive. Just as high-speed, low-density data storage and low-speed, high-density data storage media complement one another, utilizing molecules of variable energy density within the same molecules and aligning those rings in a stacked series and bridging only the tantalum (or other material traditionally associated with electrolytic capacitors) components to the cathode (i.e. they best facilitate rapid charge and discharge) and allowing the current to filter into the elsewheres of the molecules through an intra-molecular process rather than trying to pass current through thick layers, energy-dense materials may be charged with nearly the same rapidity of other materials such as lithium.

This design has the added benefit of being less likely to lead to catastrophic overheating and given that it is a solid-state concept, it does not require a liquid electrolyte.